REMEDIAL ACTION CONTRACT 2 FOR
REMEDIAL, ENFORCEMENT OVERSIGHT, AND
NON-TIME CRITICAL REMOVAL ACTIVITIES
IN REGION 5

TECHNICAL MEMORANDUM
REMEDIAL ALTERNATIVES SCREENING
DRAFT

US SMELTER AND LEAD REFINERY (USS LEAD)
SUPERFUND SITE
LAKE COUNTY, INDIANA

Prepared for
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order of Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ARCO	Atlantic Richfield Company
bgs	Below ground surface
BTV	Background threshold value
CAMU	Corrective action management unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	Constituent of concern
COI	Constituent of interest
COPC	Chemical of potential concern
CTE	Central tendency exposure
DCT	Default Closure Tables
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
FIELDS	Field Environmental Decision Support
FS	Feasibility study
GRA	General response action
HHRA	Human Health Risk Assessment
HI	Hazard index
HRS	Hazard Ranking System
IAC	Illinois Administrative Code
IDEM	Indiana Department of Environmental Management
ISBH	Indiana State Board of Health
MassDEP	Massachusetts Department of Environmental Protection
mg/kg	Milligram per kilogram
MRFI	Modified RCRA Facility Investigation
MSA	Metropolitan statistical area
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List

ACRONYMS AND ABBREVIATIONS (CONTINUED)

OERR	Office of Emergency and Remedial Response
O&M	Operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable unit
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PRG	Preliminary remediation goal
RAC	Remedial Action Contract
RAGS	Risk Assessment Guidance for Superfund
RAL	Remedial Action Level
RAO	Remedial Action Objective
RCI	Resource Consultants, Inc.
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
RI/FS	Remedial investigation/feasibility study
RISC	Risk Integrated System of Closure
RME	Reasonable maximum exposure
RSL	Regional Screening Level
SSL	Site screening level
START	Superfund Technical Assessment and Response Team
SVOC	Semi-volatile organic compound
TACO	Tiered Approach to Corrective Action Objectives
TC	Toxicity characteristic
TCLP	Toxicity Characteristic Leaching Procedure
Tech Memo	Technical memorandum
USGS	United States Geological Survey
USS Lead	U.S. Smelter and Lead Refinery
VOC	Volatile organic compound
XRF	X-ray fluorescence

SECTION 1.

INTRODUCTION

This Technical Memorandum (Tech Memo) begins the feasibility study (FS) alternatives identification and evaluation process for the U.S. Smelter and Lead Refinery (USS Lead) Superfund Site located in Lake County, Indiana, for U.S. Environmental Protection Agency (EPA) Region 5 under Work Assignment No. 154-RICO-053J (WA 154) Remedial Action Contract No. EP-S5-06-02 (RAC 2). The purpose of WA 154 is to conduct a remedial investigation/feasibility study (RI/FS) at the USS Lead Site to select a remedy that eliminates, reduces, or controls risks to human health and the environment.

The entire USS Lead Superfund Site consists of the former industrial facility located at 5300 Kennedy Avenue (hereafter referred to as operable unit [OU] 2) and the residential area north of OU-2 (hereafter referred to as OU-1). OU-1 is bounded by East Chicago Avenue on the north, East 151st Street/149th Place on the south, the Indiana Harbor Canal on the west, and Parrish Avenue on the east (Figure 1-1). This Tech Memo and the subsequent FS focus on the Residential Area, OU-1 of the USS Lead Site. Contamination at OU-2 will be addressed as part of a separate investigation.

Section 1 of this Tech Memo provides the reader with background information, including the purpose and objectives of this Tech Memo, information on the Site, a summary of the Remedial Investigation (RI) findings, and a summary of the conclusions of the Human Health Risk Assessment (HHRA).

1.1 Purpose and Organization of this Technical Memorandum

This process is defined in Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) guidance and most specifically in the 1988 CERCLA guidance document for conducting RI/FS (EPA 1988). The process was developed to gather sufficient information to support an informed risk-management decision regarding which remedy appears to be most appropriate for a given Site. The RI phase included the data collection and risk-assessment efforts. The FS phase will utilize this information to identify remedial alternatives, evaluate these alternatives, and make a recommendation regarding the alternative that appears to be most appropriate for OU-1.

The EPA Guidance specifies that the process should be flexible; thus each RI/FS process may vary in its specifics. The general process to be followed for the Site FS is shown in Figure 1-2. (**Note:** The process includes review and comment steps that are not shown on the simplified flow diagram in the figure.) The elements of the process that are addressed in this Tech Memo are indicated on the figure. In general, this Tech Memo includes the following FS efforts:

- identifying Applicable or Relevant and Appropriate Requirements (ARAR);

- identifying Remedial Action Objectives (RAO);
- indentifying preliminary Remedial Action Levels (RAL);
- establishing General Response Actions (GRA);
- identifying candidate remedial technologies;
- screening these candidate technologies and eliminating technologies that would not be effective or implementable, or are of a higher cost relative to other identified technologies without providing additional benefit; and
- developing a list of potential remedial alternatives built from the remaining candidate technologies, either as single technologies or combinations of technologies.

This process was followed with some further restrictions due to the fact that the site consists of contaminated soil in a residential neighborhood. EPA has issued guidance, the *Superfund Lead-Contaminated Residential Sites Handbook* (EPA 2003), which identifies only a few actions generally considered to be long-term protective at residential sites.

This Tech Memo is presented in six sections:

- **Section 1 – Introduction** presents information to provide the reader with an understanding of the USS Lead Site. Section 1 includes the purpose and organization of this Tech Memo, information on the Site (including Site description, Site history, and a summary of the RI findings), and a summary of the risk assessments.
- **Section 2 – Development of Remedial Objectives** presents the ARARs, RAOs, and RALs identified for the USS Lead Site. The ARARs and RAOs were used to identify GRAs and to both develop and evaluate candidate technologies and subsequently to identify potential remedial alternatives. The preliminary RALs were initially presented in the Draft RI and are restated in this section.
- **Section 3 – Identification of General Response Actions** presents the GRAs developed to achieve the identified RAOs. GRAs are general actions such as “removal” or “containment.” Candidate technologies to implement these actions are then subsequently identified.
- **Section 4 – Identification and Screening of Technologies** presents the identification of candidate technologies and the initial screening against effectiveness, implementability, and cost criteria. This section includes a summary of retained technologies.

- **Section 5 – Identification of Remedial Alternatives** presents the identified remedial alternatives built from the retained technologies to be carried forward into the FS remedial alternatives evaluations.

- **Section 6 – References** provides a list of references used in preparing this Tech Memo.

1.2 Site Description

The USS Lead Superfund Site lies approximately 18 miles southeast of Chicago, Illinois, in East Chicago, Indiana (Figure 1-1). East Chicago is surrounded by one of the most heavily industrialized areas in the U.S. including steel mills, oil refineries, heavy manufacturing, chemical-processing plants, and heavy rail. OU-1 is primarily low-income residential with commercial and light industrial areas nearby.

United States Geological Survey (USGS) historical aerial photographs from 1939, 1951, 1959, and 2005 show OU-2 and OU-1 over time (see Draft RI Figure 1-3). Review of these aerial photographs indicates that the majority of the residential neighborhoods within the USS Lead Site, west of the railroad tracks, were built before 1939. Because OU-1 is a former low-lying area, the ground level was likely built up before 1939, before the homes were constructed. Approximately half of the homes east of the railroad tracks were built before 1939. Between 1939 and 1951, approximately 75 to 80 percent of the homes were built; by 1959, most of the homes east of the railroad tracks had been built. These photographs also show that the Anaconda Copper Company (currently the Atlantic Richfield Company [ARCO]) occupied the area where both the Gosch Elementary School and the public housing residential complex immediately south of the school are currently located (the southwest portion of OU-1). The Gosch Elementary School and the East Chicago Public Housing complex were built on the former Anaconda Copper Company site after 1959. Copies of these photographs are provided in the USS Lead RI Report (SulTRAC 2011).

The East Chicago area in the vicinity of OU-2 has historically supported a variety of industries. In addition to the USS Lead smelting operation, some other industrial operations may have also managed lead and other metals. For example, immediately east of OU-2, across Kennedy Avenue, is the former DuPont site (currently leased and operated by W.R. Grace & Co., Grace Davison). One of the processes that historically took place at the DuPont site was the manufacturing of the pesticide lead arsenate. Northwest of the USS Lead Site, west of Gladiola Street and north of 151st Street, two smelter operations reportedly managed lead and other metals (Geochemical Solutions 2004). A 1930 Sanborn Map identifies the operations as Anaconda Lead Products and International Lead Refining Company (referred to in this Tech Memo as the former Anaconda facility, currently owned by ARCO) (Geochemical Solutions 2004). According to the Sanborn Map, Anaconda Lead Products was a manufacturer of white lead and zinc oxide, and the International Lead Refining Company was a metal-refining facility. These facilities consisted of a pulverizing mill, white-lead storage areas, a chemical laboratory, a machine shop, a zinc-oxide experimental unit building and plant, a silver refinery, a lead refinery, a baghouse, and other miscellaneous buildings and processing areas. Locations of these possible source facilities are presented in the Draft RI Report (SulTRAC 2011).

1.3 Site History

A graphical representation of the timeline of events at the USS Lead Site is presented as Draft RI Figure 1-6 (SulTRAC 2011). USS Lead is a former lead smelter located at 5300 Kennedy Avenue, East Chicago, Indiana. The facility (OU-2) was constructed in the early 1900s by the Delamar Copper Refinery Company to produce copper. In 1920, the property was purchased by U.S. Smelting, Refining, and Mining, and later by USS Lead. At that time, USS Lead operated a primary lead smelter at the facility. An electrolytic process called the "Betts process" was used for refining lead into high-purity lead at the Site. In the Betts process, 400-lb anodes of primary lead bullion were placed in tanks containing cathodes, anodes, and a solution of lead fluosilicate and free hydrofluosilicic acid. During electrolysis, impurities in the primary lead bullion accumulated on the anode and lead deposited on the cathode. The cathode was then removed, remelted, and treated with compressed air to oxidize and float any remaining impurities, and the purified lead was cast into lead "pigs." The Betts process volatilized metals, including arsenic, during production (Resource Consultants, Inc. [RCI] 1990).

Between 1972 and 1973, OU-2 was converted to a secondary lead smelter, which recovered lead from scrap metal and automotive batteries. A 100-ton furnace produced 1-ton lead blocks and smaller 12-lb pigs. The lead blocks and pigs were subsequently remelted and refined to soft lead, antimony lead, and calcium lead. Metal alloys used in the refining process included silver, copper, tin, antimony, and arsenic. All operations at OU-2 were discontinued in 1985. Two primary waste materials were generated as a result of the smelting operations: 1) blast furnace slag and 2) lead-containing dust emitted from the blast furnace stack. Blast-furnace slag was stockpiled south of the plant building and spread over an adjoining 21 acres of wetlands once per year. The blast furnace baghouse collected approximately 300 tons of baghouse flue dust per month during maximum operating conditions. Some of the baghouse dust was reintroduced into the furnace for additional lead recovery; however, not all of the dust could be recycled without a significant reduction in furnace efficiency. By the late 1970s, approximately 8,000 tons of baghouse dust were stored onsite (RCI 1990).

In 1975 and 1985, OU-2 received a National Pollutant Discharge Elimination System (NPDES) permit to discharge furnace cooling water and stormwater runoff to the Grand Calumet River. According to the Indiana Department of Environmental Management (IDEM), such discharges exceeded permit levels for several compounds (EPA 2009). In the 1980s, several state and federal enforcement actions were taken against the company. In September 1985, the Indiana State Board of Health (ISBH) found OU-1 in violation of State law because lead particles were found downwind of the facility (EPA 2009). All industrial operations at OU-2 ceased in 1985 (EPA 2009).

On November 18, 1993, EPA and USS Lead entered into an Administrative Order of Consent (AOC) pursuant to Section 3008(h) of the Resource Conservation and Recovery Act (RCRA).

The AOC required USS Lead to implement interim measures, including site stabilization and construction of a corrective action management unit (CAMU) to contain contaminated soils and slag, and to conduct a Modified RCRA Facility Investigation (MRFI) (Geochemical Solutions 2001). The CAMU covers approximately 10 acres and is surrounded by a subsurface slurry wall. Excavation and construction of the CAMU was conducted in two phases and completed between August and September 2002 (Geochemical Solutions 2004). The baghouse dust and bags were removed from the site pursuant to the IDEM Partial Interim Agreed Order in Cause No. N-296 and were sent offsite for secondary lead recovery. Slag generated from the blast-furnace operations was placed in piles on the southern portion of the property. The cleanup of slag was described in the Interim Stabilization Measures Work Plan prepared by ENTACT, LLC and was completed during the third quarter of 2002 (Geochemical Solutions 2004).

As part of a RCRA Corrective Action in 2003 and 2006, EPA conducted soil sampling in OU-1 of the USS Lead Site. In late July and early August 2003, 83 residential properties were sampled and analyzed for lead within OU-1 using a Niton X-ray fluorescence (XRF) instrument. Soils from 43 locations (52 percent) exceeded the 400 milligrams per kilogram (mg/kg) residential soil screening criterion for lead. In 2006, EPA's Field Environmental Decision Support (FIELDS) team supplemented the work performed in 2003 by collecting additional data from 14 properties sampled in 2003 to (1) assess whether the surface-most soils (0 to 1 inch below ground surface [bgs]) had elevated lead concentrations relative to deeper soils (1 to 6 inches bgs), (2) collect and compare composite samples to individual samples to assess whether composite samples accurately represented the concentrations in residential yards and parks, and (3) compare lead concentrations in the fine and coarse fractions of sieved samples to evaluate whether lead was preferentially distributed in the fine-grain sizes (SulTRAC 2011).

On January 22, 2008, EPA approved a time-critical removal action for private residential properties within OU-1 due to elevated levels of lead in surface soils identified during investigations conducted from 2002 through 2007 (Weston 2009). EPA identified 15 private properties that contained soil with lead concentrations exceeding the regulatory removal action level of 1,200 mg/kg in the top 6 inches of soil. EPA was able to obtain access agreements to only 13 of the 15 properties. The properties were remediated between June 9 and September 22, 2008, by the Weston Solutions, Inc. Superfund Technical Assessment and Response Team (START) and Environmental Quality Management, the Emergency Rapid Response Services contractor. The properties were excavated to a depth of 1 to 2.5 feet bgs. START used an XRF instrument to field screen and confirm that excavation was completed to a depth where lead concentrations were below 400 mg/kg. All the properties were backfilled with clean fill and re-sodded by September 25, 2008. A total of 1,838 tons of soil was transported offsite to a landfill facility as special waste (Weston 2009).

Under the Hazard Ranking System (HRS), the USS Lead Site was evaluated in September 2008, which determined that there was an observed release of lead in the air migration pathway as well as the surface-water migration pathway (EPA 2008). The USS Lead Site was listed as a Superfund site on the National Priorities List (NPL) on April 8, 2009.

1.4 Nature and Extent of Contamination Summary

The following section summarizes the nature and extent of contamination and the contaminant fate and transport at the USS Lead Superfund Site. Detailed descriptions and analyses of the nature and extent of contamination are presented in Section 5 of the Draft RI Report (SulTRAC 2011).

Between December 2009 and August 2010, as part of the RI, SulTRAC collected surface and subsurface soil samples (including drip-zone samples and quadrants from larger properties such as parks and schools) from a total of 88 properties, consisting of 232 distinct yards, in order to define the nature and extent of constituents of interest (COI) in and around OU-1. These 232 separate "yards" included 75 front yards, 70 back yards, 27 quadrants, and 60 drip zones, which were considered as separate "yards" because they covered a geographic area that was not confined to a front yard, back yard, or quadrant. All soil samples were analyzed for lead.

In addition, a subset of samples was analyzed for various combinations of total metals, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), and pesticides to provide a basis for more fully assessing contamination in shallow soils in OU-1. In Section 5 of the Draft RI, each sample result was screened against an analyte-specific site screening level (SSL). SulTRAC developed these SSLs from screening criteria in the *Superfund Lead-Contaminated Residential Sites Handbook* preliminary remediation goals (PRG) (EPA 2003), EPA residential Regional Screening Levels (RSL) (EPA 2010), IDEM's Risk Integrated System of Closure (RISC) residential default closure tables (DCT) for direct contact (IDEM 2009), and site-specific background threshold values (BTV). The SSLs that were used to evaluate the RI analytical results utilized the lowest of the following: the *Superfund Lead-Contaminated Residential Sites Handbook*, the EPA residential RSL, or the IDEM RISC residential DCT. If the site-specific BTV was greater than the lowest of the above-listed values, then the site-specific BTV was selected as the SSL. Additional detailed regarding the SSLs can be reviewed in the Draft RI Sections 2.2 and 5.0. Results from the RI soil investigation include (SulTRAC 2011):

- Ten metal analytes and 6 PAH analytes were identified as COIs
- 123/232 yards (53%) exceeded the SSL for lead in surface and/or subsurface soil
- 75/136 yards (55%) exceeded the SSL for arsenic in surface and/or subsurface soil
- 50/53 yards (94%) exceeded one or more SSLs for PAHs in surface and/or subsurface soil

A small percentage (22%) of the yards sampled during the RI were analyzed for PAHs; however, PAHs were the COIs that exceeded the SSLs in the highest proportion of samples. 191 of the 196 samples analyzed for PAHs (97%) exceeded SSLs. Data analysis indicated that lead and arsenic were generally correlated, whereas lead and PAHs were not correlated. It is unlikely that soils will exceed the arsenic SSL unless lead also exceeds the lead SSL (SulTRAC 2011).

The lateral extent of lead-impacted soil covered the entire area of OU-1. The area west of Huish Avenue contained a higher frequency of exceedances for lead in both surface and subsurface soil samples than the eastern half of OU-1. Lead concentrations in all nine properties (20 yards) sampled in the East Chicago Housing Authority complex, in the southwest portion of the study area, exceeded the SSL for lead. The highest arsenic and lead concentrations in all of OU-1 were also found in the East Chicago Housing Authority complex and may be attributed to the historical operations at the Anaconda Copper Company facility. The distribution of arsenic suggests that the primary source of arsenic in OU-1 is likely to have been the placement of impacted fill and not aerial deposition (SulTRAC 2011).

An analysis of front and back yards reveals that there is an approximately 75% chance that COIs in one yard will indicate that the other yard also contains concentrations of analytes in excess of SSLs. In addition, based on the observed vertical distributions of lead, arsenic, and PAHs, there is a 13% chance that sampling only the upper two depth intervals (0-6" and 6-12" bgs) would miss contamination in the lower two depth intervals (12-18" and 18-24" bgs). A comparison of soil type to COI concentration concluded that soil type is not a reliable indicator of the presence or absence of COIs, except that the native sands are generally free of contamination. The figures in Section 5.0 of the Draft RI illustrate the nature and extent of COIs at the Site (SulTRAC 2011).

1.5 Contaminant Risk Assessment Summary

A HHRA was conducted at the USS Lead Site during the RI. The HHRA evaluated the potential exposure of human receptors to constituents detected in environmental media at the USS Lead Site. The objectives of the HHRA were to determine whether site-related constituents detected in environmental media pose unacceptable risks to current and future human receptors and to provide information to support decisions concerning the need for further evaluation or action based upon current and reasonably anticipated future land use. In the HHRA risk characterization, the toxicity factors were integrated with concentrations of chemicals of potential concern (COPC) and intake assumptions to estimate potential cancer risks (risks) and non-carcinogenic hazards. Risks and hazards were calculated using standard risk assessment methodologies (EPA 1989). Risks were compared to EPA’s risk range: from 1E-06 (one cancer per one million exposed receptors) to 1E-04 (one cancer per ten thousand exposed receptors). Risks less than 1E-06 are considered insignificant. Risks within the range are remediated at the discretion of risk managers, while risks greater than 1E-04 typically require remediation (EPA 1991). Hazards are compared to a target hazard index (HI) of 1 (EPA 1989). Risks posed by lead in soil were evaluated by comparing lead exposure point concentrations (EPC) in soil at each property to receptor-specific lead PRGs.

The following discussion summarizes the results of the HHRA, the risks and hazards under current and future land use, and reasonable maximum exposure (RME) conditions. The discussion is organized by property type. The section concludes with a brief statement comparing

RME and central tendency exposure (CTE) results. Additional information regarding the HHRA can be found in Section 7.0 and Appendix E of the Draft RI Report (SulTRAC 2011).

Residential Properties

- Under both current and future land use conditions, about 35 percent of the properties sampled have acceptable risks and HI (i.e., soil-lead EPCs less than soil PRGs, risk estimates less than 1E-06, and HIs below 1.0). These properties are located primarily in the eastern one-third of the site.
- Under current and future land use conditions, between 36 and 45 percent of the properties have total risks greater than 1E-04 (the upper end of EPA's risk range). These total risks are driven by potential exposure to arsenic and PAHs through ingestion of homegrown produce and incidental ingestion of soil.
- Hazards greater than 1 are driven by potential exposure to arsenic, antimony, manganese, and mercury, as well as a number of other metals at a small number of properties through the same exposure pathways as for risks.
- Properties with risks only from lead are split about evenly in two primary groups: the area of public housing in the southwest portion of the site and the eastern one-third of the site.

Carmelite School for Girls

- Under both current and future land use conditions, total risks for both adolescent students and adult teachers and staff are within EPA's risk range of 1E-06 to 1E-04. Total risks are driven by potential exposure to PAHs through ingestion of homegrown produce and incidental soil ingestion.
- Under both current and future land use conditions, all HIs are less than 1 and insignificant, and there are no risks from lead.

Carrie Gosch Elementary School

- Under both current and future land use conditions, total risks to adolescent students and adult teachers and staff (both indoor and outdoor) are within EPA's risk range, from 1E-06 to 1E-04. Total risks are driven by potential exposure to PAHs through incidental ingestion of and dermal contact with soil.
- Under both current and future land use conditions, all HIs are less than 1 and insignificant, and there are no risks from lead.

Recreational

- Under both current and future land use conditions, there are no unacceptable risks (risk is less than 1E-06) or hazards, and no risks from lead at the Melville Avenue Park.
- Under both current and future land use conditions, total risks for all recreational receptors (child, adolescent, and adult recreationalists and adult indoor and outdoor workers) are within EPA's risk range from 1E-06 to 1E-04 for the other three parks: Goodman Park,

Riley Park, and Kennedy Gardens Park. Total risks are driven by potential exposure to arsenic and PAHs through incidental ingestion of and dermal contact with soil.

- Under both current and future land use conditions, there are no unacceptable hazards at any of the three parks (Goodman, Riley, and Kennedy Gardens Parks).
- Under both current and future land use conditions, there are no lead risks at Riley Park; at Goodman Park, lead presents a risk to the child recreationalist, the indoor worker, and the outdoor worker; and at Kennedy Gardens Park, lead presents a risk to all potential recreational receptors. (**Note:** Both indoor and outdoor workers do not currently exist at Kennedy Gardens Park. Risks to these receptors are entirely theoretical and would occur in the future only.)

Utility Workers

- At three properties (4737 Euclid Ave., 4850 Ivy St., and 508 E. 151st St.), total risks are less than 1E-06 and insignificant. At 13 additional properties, no carcinogenic COPCs were identified.
- Seventy-seven properties (residential, recreational, and school), total risks are within EPA's risk range of 1E-06 to 1E-04. Total risks are driven by potential exposure to arsenic and PAHs through incidental ingestion of soil.
- Under both current and future land use conditions, HIs are less than 1 and insignificant at all but one of the properties. The HI at 5100 Aster Ave. is 1.2; all COPC-specific hazards are less than 1. Lead poses a risk to utility workers at three properties: 418 E. 150th Place, 4928 Aster Ave., and 5100 Aster Ave.

Construction Workers

- Total risks at seven properties (five in the area of public housing) are within EPA's risk range from 1E-06 to 1E-04 and are driven by potential exposure to arsenic through incidental ingestion of and dermal contact with soil.
- Total risks at the remaining 59 properties are less than 1E-06 and insignificant.
- HIs exceed 1 at 11 properties.
- Lead risks were unacceptable at 16 properties, the majority of which are at or near the area of public housing.

RME *versus* CTE Conditions

The overall conclusions based on RME conditions remain when considering CTE conditions. However, the absolute magnitude of the total risks and hazards decreases.

Based on the nature and extent summary and HHRA discussion above, the constituents of concern (COC) at OU-1 are lead, arsenic, and PAHs. Contaminant-specific, preliminary RAOs were developed in the RI and are presented below in Section 2.2.

SECTION 2.

DEVELOPMENT OF PRELIMINARY REMEDIAL OBJECTIVES

The process of identifying and screening technologies begins with the creation of the remedial objectives. This section presents the remedial objectives of the FS process, which includes the ARARs and RAO.

CERCLA specifies that Superfund remedial actions must meet any Federal standards, requirements, criteria, or limitations that are determined to be legally ARARs. Also included is the new provision that state ARARs must be met if they are more stringent than federal requirements (EPA 1988).

EPA's RI/FS guidance defines RAOs thus: "Remedial Action Objectives consist of medium-specific or operable unit-specific goals for protecting human health and the environment. The RAOs should be as specific as possible but not so specific that the range of alternatives that can be developed is unduly limited" (EPA 1988). The USS Lead RAO is presented for OU-1 only. Groundwater at the USS Lead Site is being addressed as part of OU-2. Together the ARARs and RAO begin to create the site-specific "regulatory" framework for the remedial action, and hence, the final remedy to meet.

RALs are long-term levels used during the analysis and selection of remedial alternatives, and during the remedial design and remedial action processes. The RALs are used to define the extent of contaminated soil required remedial action.

The sections below present the ARARs, RAO, and RALs.

2.1 Applicable or Relevant and Appropriate Requirements

Regulatory requirements, standards, and guidance are referred to as ARARs. ARARs depend on the detected contaminants, specific site characteristics, and particular remedial actions proposed for the site. This section discusses the identification of ARARs for OU-1.

Under Section 121(d)(1) of CERCLA, remedial actions must be protective of human health and the environment. Additionally, CERCLA remedial actions must meet a level and standard of control that attains standards, requirements, limitations, or criteria that are "applicable or relevant and appropriate" under the circumstances of the release. These requirements are derived from federal and state laws and are known as ARARs. Federal, state, or local permits are not necessary for removal or remedial actions implemented under a CERCLA remedial action, but applicable substantive requirements or ARARs must be met.

The National Oil and Hazardous Substance Pollution Contingency Plan (NCP) (40 *Code of Federal Regulations* [CFR] 300.5) defines applicable requirements as

> "…those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site."

The NCP (40 CFR 300.5) defines relevant and appropriate requirements as

> "…those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility citing laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site."

State requirements identified in a timely manner and that are more stringent than corresponding federal requirements may be applicable or relevant and appropriate. Three types of ARARs are identified on a site-specific basis: chemical-, location-, and action-specific ARARs. Each type of ARAR is briefly described below.

Chemical-specific ARARs usually are health- and risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. These values and methodologies (such as promulgated standards and risk assessments, respectively) establish acceptable concentrations of a chemical contaminant that can remain in the environment.

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because the site-specific location is of environmental importance.

Action-specific ARARs usually are technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities selected to accomplish a remedy.

This Tech Memo considers all federal and state requirements as potential ARARs for OU-1. Table 2-1 summarizes the specific ARARs identified as to be considered, potentially applicable, or relevant and appropriate for soil at OU-1.

2.2 Remedial Action Objectives

RAOs are goals specific to media or operable units for protecting human health and the environment. Risk can be associated with current or potential future exposures. RAOs should be as specific as possible, but not so that the range of alternatives to be developed is unduly limited. Objectives aimed at protecting human health and the environment should specify: (1) chemicals of concern; (2) exposure routes and receptors; and (3) an acceptable contaminant level or range of levels for each exposure route (that is, a RAL) (EPA 1988).

The USS Lead OU-1 HHRA recognized the following receptors for current and future land use scenarios: child, adolescent, and adult residents; child, adolescent, and adult recreationalists; and adult indoor and outdoor workers. Section 7.2 of the Draft RI details the exposure routes for each receptor (SulTRAC 2011). Current land uses within OU-1 include residential, recreational, school, and industrial/commercial properties. For the purpose of the HHRA, future land uses of all properties are assumed to be the same as current land uses. In addition to the primary types of receptors associated with each property (for example, adult and child residents at residences, and students, faculty, and staff at schools, etc.), the risk assessment also considers potential exposures of workers involved in utility installation and repair and construction activities at each property (SulTRAC 2011).

The NCP requires that a range of risks (1E-04 to 1E-06 excess lifetime cancer risk) be evaluated (EPA 1994). Higher risks (1E-04) may be considered when the exposed population is small, risks were developed using very conservative assumptions, and where it is unlikely that children and sensitive sub-populations would be exposed (SulTRAC 2011). The RAO below addresses soil lead EPCs less than soil PRGs, cancer risks greater than 1E-06, and non-cancer hazards greater than 1. However, the risk thresholds ultimately will be selected by EPA based on site-specific conditions and factors.

The preliminary RAO for soil at OU-1 includes primarily native and fill soils, but may also include minor amounts of other materials. The preliminary RAO for OU-1 is to

- Reduce to acceptable levels human health risk from exposure through ingestion, direct contact, or inhalation exposure pathways to COCs in impacted surface and subsurface soils assuming reasonably anticipated future use scenarios.

Historically, impacted soils were used as fill in areas that are now within OU-1 of the USS Lead Site. Portions of OU-1 are currently paved or covered with buildings, limiting potential exposure. However, significant portions of the site, representing yards, parks, and lawns, are unpaved. The intent of this RAO is to address open areas to protect residents, recreationalists, and workers.

2.3 Preliminary Remedial Action Levels

RALs are long-term levels used during the analysis and selection of remedial alternatives, and during the remedial design and remedial action processes. The OU-1 preliminary RALs comply with ARARs and support the OU-1 RAO presented in Sections 2.1 and 2.2, respectively. The RALs are considered preliminary, in that the final RALs are defined in the Record of Decision once the remedy for OU-1 is selected. The RALs are used to define the extent of contaminated soil required remedial action. The residual risks (including both carcinogenic risks and noncarcinogenic hazards) left in place by the RALs comply with the NCP requirements for protection of human health and the environment.

The RALs were calculated based on site-specific risks and hazards from the human health and ecological risk assessments, as presented in the Draft RI (SulTRAC 2011). The primary COCs are lead, arsenic, and PAHs. RALs for the soil at OU-1 are presented below and in Table 2-2.

2.3.1 Preliminary Lead Remedial Action Levels

The preliminary RAL for lead at OU-1 is 400 mg/kg for residential areas and 800 mg/kg for industrial areas (see Table 2-2). The RAL is set based on the *Superfund Lead-Contaminated Residential Sites Handbook* (EPA 2003), EPA RSLs (EPA 2010), and the State of Indiana's *RISC Technical Resource Guidance Document* for direct contact with soils (IDEM 2009).

2.3.2 Preliminary Arsenic Remedial Action Level

The preliminary RAL for arsenic at OU-1 is 14.1 mg/kg (see Table 2-2), based on site-specific background measurements for arsenic in the top 6 inches of soil samples collected from background locations. Comparison of the strictly risk-based EPA residential RSL (EPA 2010) for arsenic (0.39 mg/kg) to site-specific background concentrations indicates the presence of naturally occurring arsenic at the site. The Illinois EPA determined background metropolitan arsenic concentrations in soil to be 13.0 mg/kg (35 Illinois Administrative Code [IAC] Part 742). Although the USS Lead Site is not within Illinois, it is approximately 5 miles from the City of Chicago and the Illinois-Indiana state border. Use of the site-specific background level of 14.1 mg/kg was considered acceptable, based on the similarity between the metropolitan area background levels and those measured at OU-1 (SulTRAC 2011).

2.3.3 Preliminary Polycyclic Aromatic Hydrocarbon Remedial Action Levels

The preliminary RALs for PAHs at OU-1 have been set to the Illinois Tiered Approach to Corrective Action Objectives (TACO) criteria for metropolitan areas (see Table 2-2). PAHs were identified in the RI as exceeding the EPA RSLs in 190 of the 196 total samples tested for PAHs (SulTRAC 2011). However, as discussed in Section 8.4.3 of the Draft RI, an attempt was made to assess site-specific background levels of PAHs in close proximity to OU-1; however, the results of background PAH measurements were not consistent with similar studies conducted in the Chicago Metropolitan area (USGS 2003, 35 IAC Part 742) or other metropolitan areas (Mauro, et al. 2006, MassDEP 2002). PAH background concentrations in urban soils in the Midwest and northeastern U.S. are significantly higher than the site-specific background values derived for OU-1, which has different soil types from the background locations. See the Draft RI for a more extensive explanation of the rationale for not using the site-specific background values. As a result, the TACO criteria for metropolitan areas are considered to be more appropriate RALs for PAHs than the site-specific background values when the risk-based RSL is below the metropolitan background value. Although Illinois TACO criteria do not apply to sites located outside Illinois, the TACO criteria for metropolitan areas appear to be the most appropriate criteria for OU-1 because East Chicago lies within the Chicago metropolitan statistical area (MSA), but not within the City of Chicago. Using the EPA RSLs and Illinois

TACO PAH background concentrations for MSAs where appropriate allows for a reasonably achievable and practical RAL to be established for OU-1 (SulTRAC 2011).

SECTION 3.

IDENTIFICATION OF GENERAL RESPONSE ACTIONS

Section 3 presents the GRAs developed to achieve the RAO identified in Section 2. GRAs are broad categories of possible remedial actions, such as containment or removal. Technologies are separated into GRA categories. The identification of potential technologies was done in order to identify technologies that may be capable of attaining the RAO. The established performance of each technology with regard to site contaminants and conditions is considered during technology identification and screening. The potential technologies are screened based on effectiveness, implementability, and relative cost. The GRAs are then used to identify specific remedial technologies that may be implemented at the site in Section 4.

GRAs for OU-1 soil at the USS Lead Site are listed in Table 3-1. As noted, the GRAs are used to identify and group potential remedial technologies.

SECTION 4.

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section identifies and screens remedial technologies proposed for the remediation of the OU-1. The identification and screening is completed using the processes outlined in the EPA's RI/FS guidance (EPA 1988) and the NCP (EPA 1994). First, technologies are identified that may be capable of attaining the RAOs listed in Section 2.0. During technology identification, the demonstrated performance of each technology with regard to site contaminants and conditions is considered. The result is a list of potential remedial technologies that are then screened based on effectiveness, implementability, and relative cost. The purpose of this screening is to produce an inventory of suitable technologies that can be assembled into candidate remedial alternatives capable of mitigating actual or potential risks at OU-1. Consistent with EPA guidance, an extensive list of potential technologies representing a range of GRAs was considered to develop the candidate remedial alternatives.

Categories of remedial technologies were identified based on a review of literature, vendor information, performance data, and experience in developing other FSs under CERCLA. Technologies considered potentially applicable to achieving RAOs were selected for screening. The technology screening process reduces the number of potentially applicable technologies by evaluating factors that may influence process-option effectiveness and implementability. This overall screening is consistent with guidance for performing FSs under CERCLA (EPA 1988).

The screening process assesses each technology for its probable effectiveness, implementability, and relative cost with regard to site-specific conditions, site-related contaminants, and affected environmental media. The effectiveness evaluation focuses on (1) whether the technology is capable of handling the estimated areas or volumes of media and meeting the contaminant-reduction goals identified in the RAO, (2) the effectiveness of the technology in protecting human health and the environment during the construction and implementation phases, and (3) how proven and reliable the technology is with respect to contaminants and conditions at the site.

Implementability encompasses both the technical and administrative feasibility of implementing a technology process. Technical implementability is used as an initial screen of technology types to eliminate those that are clearly ineffective or unworkable at a site. Technical implementability is used as a check that the technology is applicable to the site. An additional, more detailed evaluation of technologies will be conducted during the FS. The more detailed evaluation of technologies places greater emphasis on the institutional aspects of implementability, such as the ability to obtain necessary permits for off-site actions; the availability of treatment, storage, and disposal services (including capacity); and the availability of necessary equipment and skilled workers to implement the technology. For technology screening purposes, implementability is broken down to three levels: easy to implement, implementable, and difficult to implement.

Cost plays a limited role in the screening of technologies. Relative capital and operation and maintenance (O&M) costs, rather than detailed estimates, are considered. At this stage in the process, the cost analysis is made on the basis of engineering judgment, and each technology is evaluated as to whether costs are high, low, or moderate relative to other technology options for the same medium (EPA 1988). The relative cost for each technology was determined in terms of general technology cost, not site-specific costs.

A two-step process was used in this effort. The initial step was to identify a wide range of potential technologies based on past experience and general knowledge of remedial options. The second step was to conduct the initial screening of these technologies as described above. The product of this effort is a list of retained technologies to be considered when developing potential remedial alternatives to be carried forward to the FS alternatives evaluation process.

The following sections identify and discuss the possible remedial technologies for OU-1.

4.1 Candidate Technology Identification

Identified candidate technologies for mitigation of risk are presented in Table 4-1, Soil Candidate Technologies for Risk Mitigation, which includes a list of candidate technologies, a brief description of the technologies, and specific comments on the application of the technology.

4.2 Candidate Technology Screening

The potential technologies identified in Table 4-1 were screened for effectiveness, implementability, and relative cost as described above. The potential technologies were screened based on the COCs for OU-1, which are lead, arsenic, and PAHs. The results of this screening effort are presented in Table 4-2, Soil Remediation Candidate Technologies Screening, which includes the assessment of effectiveness, implementability, and relative cost of each identified technology. The tables also note whether the technology is to be retained and, if not, the specific reason for elimination.

It should be noted that the screening presented in these tables is the screening of technologies as *primary* remedial mechanisms. However, even if a technology is eliminated as a *primary* remedial mechanism, it may still be a part of an overall approach.

4.3 Retained Candidate Technologies

The potential remedial technologies still under consideration for mitigation of identified risk are presented in Table 4-3, Soil Retained Technologies for Risk Mitigation, which also includes comments on the potential application of each technology to OU-1.

The retained technologies listed in Table 4-3 are the building blocks used to develop potential remedial alternatives in Section 5 of this Tech Memo.

SECTION 5.

IDENTIFICATION OF REMEDIAL ALTERNATIVES

Technically feasible technologies that are retained after screening are combined to form remedial alternatives that may be applicable to OU-1, the contaminated soil media, and the COCs. Technologies potentially capable of attaining the project RAO are assembled, either singly or in combination, into remedial alternatives.

In accordance with EPA guidance, during the FS, the potential remedial alternatives identified below will be screened against the short- and long-term aspects of three broad criteria: effectiveness, implementability, and cost. The purpose of the alternatives screening evaluation is to reduce the number of alternatives chosen for a more thorough and extensive analysis, and alternatives will be evaluated more generally during the screening evaluation than during the detailed analysis (EPA 1988). Quantitative cost estimates are not developed during screening of alternatives. Rather, based on knowledge of relative costs, professional judgment is used to identify the relative cost-effectiveness of each alternative. Detailed cost evaluations will be developed later in this FS process as a part of the detailed evaluation of alternatives that pass the screening process.

Remedial alternatives for soil must address the potential for ingestion, direct contact, and inhalation risks to site users. The following sections discuss the soil remedial alternatives identified based on the technologies that have passed screening for each investigation area.

The following remedial alternatives will be screened in the FS:

- **Alternative 1 – No Action.** No action will be taken to mitigate risk. This alternative is required to be evaluated by the NCP.

- **Alternative 2 – Institutional Controls.** Implement property use and access restrictions limiting future property usage and require that any excavation be done with knowledge of residual contamination such that proper precautions are taken to protect site users from exposure to COCs in soil. In accordance with CERCLA requirements, 5-year reviews would be required with this alternative, because impacted soil would be left in place.

- **Alternative 3 – On-Site Soil Cover + Institutional Controls.** This alternative involves covering of soil. A visible barrier, such as orange construction fencing or landscaping fabric, would be placed over the contaminated soil and beneath the cover. Residual contamination will be left in place and covered with an on-site soil cover that will restrict direct contact with contaminated soil. Institutional Controls will be implemented to maintain the integrity of the soil cover for the protection of site users from exposure to COCs in soil. In accordance with CERCLA requirements, 5-year reviews would be required with this alternative, because impacted soil would be left in place.

- **Alternative 4a – Soil Excavation of Soil Exceeding RALs + Off-Site Disposal + *Ex Situ* Treatment Option.** This alternative incorporates excavation of soil exceeding RALs, the disposal of excavated soil at an off-site Subtitle D landfill, and *ex situ* treatment of soil using chemical stabilization to address soil exceeding the toxicity characteristic (TC) regulatory threshold (as determined by the Toxicity Characteristic Leaching Procedure [TCLP]). EPA's land disposal restrictions (LDR) (40 CFR 268) require treatment of soils exceeding the TCLP limit of 5 mg/L for lead before disposal. Soil exceeding RALs will be excavated to a depth determined by pre-remedial sampling results. The maximum excavation depth is estimated to be 24 inches bgs; however, the final excavation depth may vary based on pre-remedial sampling results. Any contaminated soil below 24 inches bgs would have a visual barrier, such as orange construction fence or landscape fabric, placed above the contaminated soil and beneath the clean backfill soil. As required to meet LDR, soil will be treated *ex situ* using chemical stabilization. The chemical stabilization substance(s) will bind with the COCs to reduce the COC concentrations to below the TC regulatory threshold, such that treated soil can be disposed of in a Subtitle D landfill. If the *ex-situ* soil treatment is unable to reduce the necessary constituent concentrations to below the TC regulatory threshold, the treated soil that exceeds the TC regulatory threshold will be disposed of in a Subtitle C landfill. Excavated soil will be replaced with clean soil to maintain the original grade. Any soil that exceeds RALs that is left in place below 24 inches bgs would require 5-year reviews, in accordance with CERCLA requirements.

- **Alternative 4b – Soil Excavation to Native Sand + Off-Site Disposal + *Ex Situ* Treatment Option.** This alternative incorporates excavation of soil exceeding RALs, with a goal of total removal of impacted soils, the disposal of excavated soil at an off-site Subtitle D landfill, and *ex-situ* treatment of soil using chemical stabilization to address soil exceeding the TC regulatory threshold. Soil in yards that exceed the RALs based on pre-remedial sampling results will be excavated from surface grade down to the native sand soil horizon, which is estimated to be no more than 2 feet bgs, based on results of the RI. This would result in the complete removal of lead-impacted soil. RI results indicated that the native sand beneath the fill soils at the site is both clean and very easily distinguished visually. As required to meet LDR, excavated soil will be treated *ex situ* using chemical stabilization. The chemical stabilization substance(s) will bind with the COCs to reduce the COC concentrations to below the TC regulatory threshold, such that treated soil can be disposed of in a Subtitle D landfill. If the *ex-situ* soil treatment does not decrease the necessary constituent concentrations to below the TC regulatory threshold, the treated soil that exceeds the TC regulatory threshold will be disposed of in a Subtitle C landfill. Excavated soil will be replaced with clean soil to maintain the original grade. This alternative would achieve total removal of impacted soils; therefore, 5-year reviews would not be required, as no contamination would be left behind.

- **Alternative 5 – *In Situ* Treatment by Chemical Stabilization.** This alternative involves treating the soil that exceeds RALs *in situ* through the addition of chemical amendments, such phosphates in the form of ground fish bones, to immobilize lead. Stabilization is accomplished by reducing the contaminant toxicity through decreasing contaminant bioavailability. The phosphates in the ground fish bones bind with the metals in the soil to decrease the bioavailability of the metals. The ground fish bones can be directly mixed into soil using standard soil-mixing practices, such as rototilling. Institutional Controls may be implemented to address maintain the integrity of the soil cover, for the protection of site users from exposure to COCs in soil. In accordance with CERCLA requirements, 5-year reviews would be required with this alternative, because impacted soil would be left in place.

SECTION 6.

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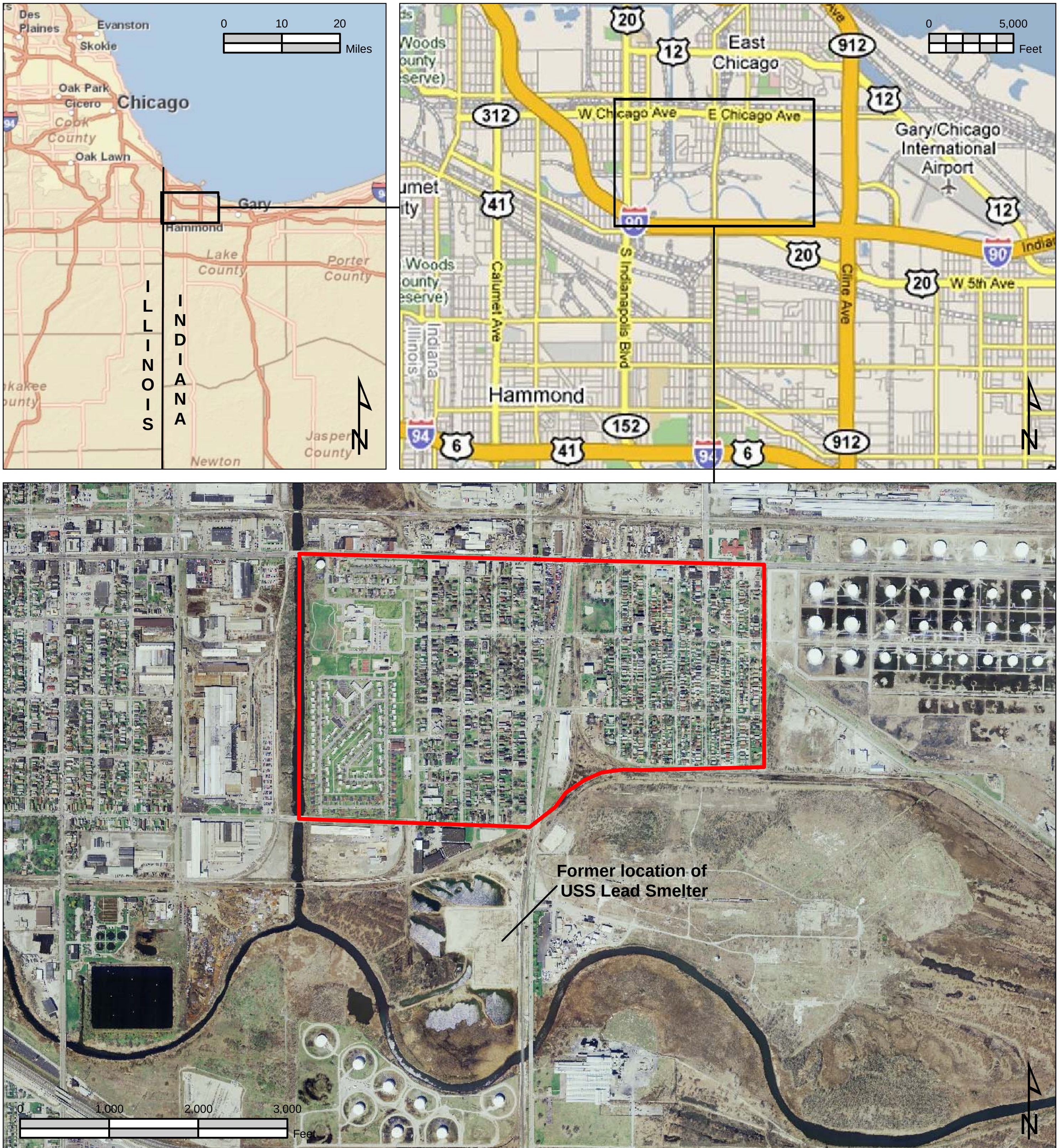
FIGURES



OU-1 boundary

Imagery sources (clockwise from upper left):
ESRI Resource Center
Google Maps
ISDP (Indiana Spatial Data Portal)

US SMELTER & LEAD REFINERY
LAKE COUNTY, EAST CHICAGO, INDIANA

TECHNICAL MEMORANDUM NO. 2

FIGURE 1-1

USS LEAD RESIDENTIAL AREA SITE LOCATION MAP

EPA REGION 5 RAC 2 | REVISION 0 | SEPTEMBER 2011

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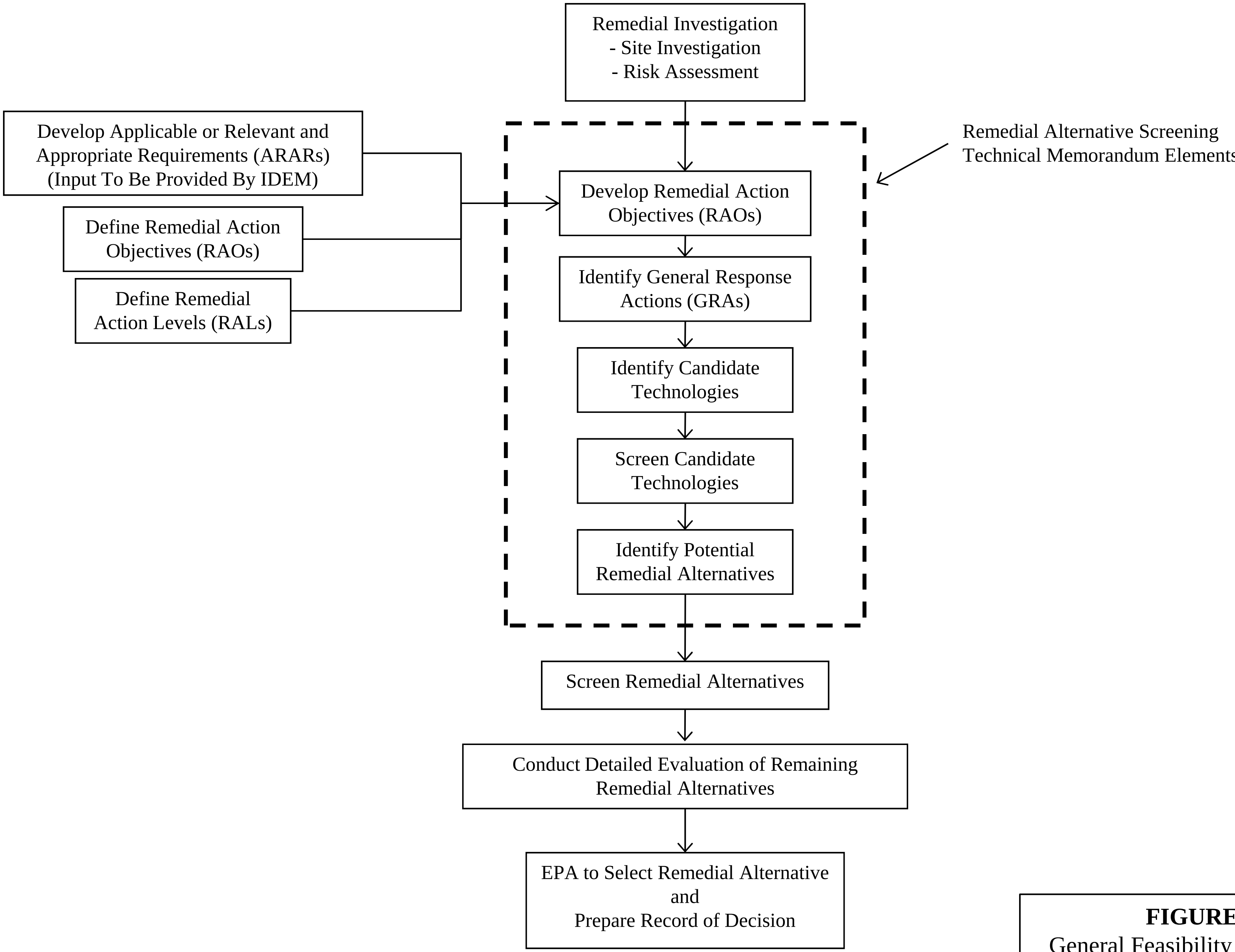

FIGURE 1-2
General Feasibility Study Process

USS Lead Site, OU-1
East Chicago, Indiana

TABLES

TABLE 2-1
List of Potentially Applicable/Relevant and Appropriate Requirements
USS Lead Site, OU-1
East Chicago, Indiana

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
CLEAN AIR ACT (CAA) of 1974				
40 CFR 7401	The Act is intended to protect the quality of air and promote public health. Title I of the Act directed the USEPA to publish national ambient air quality standards for "criteria pollutants." In addition, USEPA has provided national emission standards for hazardous air pollutants under Title III of the Act. Hazardous air pollutants are also designated hazardous substances under CERCLA. The Clean Air Act amendments of 1990 greatly expanded the role of National Emission Standards for Hazardous Air Pollutants by designating 179 new hazardous air pollutants and directed USEPA to attain maximum achievable control technology standards for emission sources. Such emission standards are potential ARARs if selected remedial technologies produce air emissions of regulated hazardous air pollutants.	Action- Specific	Potentially Applicable	The Act is considered an ARAR for remedies that involve creation of air emissions, such as excavation activities that might create dust. Also includes emissions rules which apply to equipment working on the project (based on date of manufacture and/or rebuild and/or overhaul).
FLOODPLAIN MANAGEMENT EXECUTIVE ORDER No. 11988				
40 CFR Part 6, Appendix A	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/construction within a floodplain may not be selected unless a determination is made that no practicable	Location-Specific	Potentially Applicable	Determined by Grand Calumet River floodplain

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
	alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.			
CLEAN WATER ACT (CWA) OF 1977				
Protection of Wetlands Executive Order 11990 [40 CFR Part 6, Appendix A]	Under this Order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If remediation is required within wetland areas and no practical alternative exists, potential harm must be minimized and action taken to restore natural and beneficial values.	Location-Specific	To Be Considered	Determined by location of wetlands, if any, along Grand Calumet River
Federal Water Pollution Control Act Section 401: Water Quality Certification	Establishes a permit program to regulate a discharge into the navigable waters of the U.S., including wetlands.	Chemical-Specific	Relevant and Appropriate	Depends on nature of remedial action chosen.
National Pollutant Discharge Elimination System (NPDES) 33 U.S.C. §§1251-1387	Regulates discharges of pollutants to navigable waters.	Action-Specific and may be Chemical-specific	Relevant and Appropriate	Depends on nature of remedial action chosen. Applies to disturbances of one acre or more of total land area and disturbances of less than one acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one or more acres of land.

TABLE 2-1
List of Potentially Applicable/Relevant and Appropriate Requirements
USS Lead Site, OU-1
East Chicago, Indiana

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
Clean Water Act NPDES Permit Program (40 CFR 122)				
FISH AND WILDLIFE COORDINATION ACT				
Fish and Wildlife Coordination Act; 16 U.S.C. §661 et seq. 16 USC 742a 16 USC 2901 40 CFR 6.302 50 CFR 402	Actions that affect species/habitat require consultation with U.S. Department of Interior, U.S. Fish and Wildlife Service, and National Marine Fisheries Service, and/or state agencies, as appropriate, to ensure that proposed actions do not jeopardize the continued existence of the species or adversely modify or destroy critical habitat. The effects of water-related projects on fish and wildlife resources must be considered. Action must be taken to prevent, mitigate, or compensate for project-related damages or losses to fish and wildlife resources. Consultation with the responsible agency is also strongly recommended for on-site actions. Under 40 CFR Part 300.38, these requirements apply to all response activities under the National Contingency Plan.	Location-Specific	Potentially Applicable	
RESOURCE CONSERVATION AND RECOVERY ACT OF 1976				
Off-Site Land Disposal Subtitle C [40 CFR 260-	Soil and/or sediment that is excavated for off-site disposal and constitutes a hazardous waste must be managed in accordance with the requirements of RCRA.	Action-Specific	Potentially Applicable	Depends on nature of remedial action chosen

TABLE 2-1
List of Potentially Applicable/Relevant and Appropriate Requirements
USS Lead Site, OU-1
East Chicago, Indiana

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
268]				
Land Disposal Restrictions [40 CFR 268]	The land disposal restrictions (LDR) provide a second measure of protection from threats posed by hazardous waste disposal by ensuring that hazardous waste cannot be placed on the land until the waste meets specific treatment standards to reduce the mobility or toxicity of its hazardous constituents.	Action-Specific	Applicable	Depends on nature of remedial action chosen
Off-Site Land Disposal Subtitle D [40 CFR 258]	Criteria for Municipal Solid Waste Landfills, establishes requirements for the operation of landfills accepting non-hazardous solid waste. These requirements would be applicable to facilities used for the disposal of non-hazardous soil and/or sediment.	Action-Specific	Potentially Applicable	Depends on nature of remedial action chosen
Criteria for Municipal Solid Waste Landfills for Site Capping [40 CFR 258, Subpart F]	Provides minimum standards for cover systems at solid-waste disposal facilities.	Action-Specific	Potentially Relevant and Appropriate	Depends on nature of remedial action chosen
ENDANGERED SPECIES ACT				
Endangered Species Act [16 USC 1531]; 50 CFR 200	Requires that federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or adversely modify critical habitat.	Location- Specific	Potentially applicable	No endangered species are known to be present on the site that would be affected by remedial actions.

TABLE 2-1
List of Potentially Applicable/Relevant and Appropriate Requirements
USS Lead Site, OU-1
East Chicago, Indiana

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
NATURAL HISTORIC PRESERVATION ACT				
National Historic Preservation Act [16 USC 661 et seq.] 36 CFR Part 65	Establishes procedures to provide for preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If scientific, historical, or archaeological artifacts are discovered at the site, work in the area of the site affected by such discovery will be halted pending a completion of any data recovery and preservation activities required pursuant to the act and any implementing regulations.	Location- Specific	Potentially applicable	No part of the USS Lead Residential Area is listed on the national register of historic places. Potentially applicable during remedial activities if scientific, historic, or archaeological artifacts are identified during implementation of the remedy.
DEPARTMENT OF TRANSPORTATION				
Requirements for the Transport of Hazardous Materials [40 CFR 172]	Transportation of hazardous materials on public roadways must comply with the requirements.	Action-Specific	Potentially Applicable	Depends on nature of remedial action chosen
OTHER FEDERAL GUIDELINES TO BE CONSIDERED				
Integrated Risk Information System (IRIS)	Risk reference doses (RfD) are estimates of daily exposure levels that are unlikely to cause significant adverse non-carcinogenic health effects over a lifetime. Cancer Slope Factors (CSF) are used to compute the incremental cancer risk from exposure to site contaminants and represent the most	Chemical-Specific	To Be Considered	

TABLE 2-1
List of Potentially Applicable/Relevant and Appropriate Requirements
USS Lead Site, OU-1
East Chicago, Indiana

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
	up-to-date information on cancer risk from EPA's Carcinogen Assessment Group.			
EPA Regional Screening Levels	EPA Regional Screening Levels (RSLs and associated guidance necessary to calculate them) are risk-based tools for evaluating and cleaning up contaminated sites. The RSLs represent Agency guidelines and are not legally enforceable standards.	Chemical-Specific	To Be Considered	
Occupational Safety and Health Act [29 CFR 61]	The Act was passed in 1970 to ensure worker safety on the job. The U.S. Department of Labor oversees it. Worker safety at hazardous waste sites is addressed under 29 CFR 1910.120: Hazardous Waste Operations and Emergency Response. General worker safety is covered elsewhere within the law.	Action-specific	Potentially Applicable	The Act is considered an ARAR for construction activities performed during the implementation of remedies. Depends on nature of remedial action chosen.
INDIANA ADMINISTRATIVE CODE				
Indiana Solid Waste Rules (IAC Title 329)	This law applies to remedies that involve off-site disposal of materials typically involved with excavations. Contaminated soils or wastes that are excavated for off-site disposal would be tested for hazardous waste characteristics and, if soil or waste is found to be hazardous waste, the requirements of the Rules would be followed.	Action - Specific	Potentially Relevant and Appropriate	Depends on nature of remedial action chosen.
Indiana Air Pollution	This law applies to the regulation air emissions, for activities such as excavation,	Action- Specific	Potentially Relevant and Appropriate	Depends on nature of remedial action chosen.

TABLE 2-1
List of Potentially Applicable/Relevant and Appropriate Requirements
USS Lead Site, OU-1
East Chicago, Indiana

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
Control Regulations (IAC Title 326)	that have the potential to create dust.			
Voluntary Remediation of Hazardous Substances and Petroleum (Indiana Code [IC] 13-25-5)	IC 13-25-5 established the Voluntary Remediation Program in 1993 and gave the IDEM the authority to establish guidelines for voluntary site closure. Under this authority IDEM developed a nonrule policy document, the Risk Integrated System of Closure (RISC), to guide site closures within the authority of IDEM's remediation programs. This guidance document does not have the effect of law.	Chemical-specific	To Be Considered	The RISC document provides a methodology for establishing remedial goals and determining that remediation has been achieved. The RISC policy does not apply to Superfund sites, but does apply to remedial sites under several state programs, including the state version of RCRA, the state Leaking Underground Storage Tank program, the State Cleanup Program (state equivalent of the Federal Superfund Program) and the Voluntary Remediation Program.
Contained in Policy Guidance for RCRA	Guidance document on management of remediation waste. This guidance document does not have the effect of law.	Chemical-specific	To Be Considered	
CITY OF EAST CHICAGO				
Ordinance for the Control of Stormwater	Regulates the capture and conveyance of stormwater runoff in order to mitigate the damaging effects of stormwater runoff; correct stormwater collection and conveyance problems; protect public health, welfare, safety, and the environment, and fund the activities of stormwater management including design,	Action-specific	Relevant and Appropriate	Depends on nature of remedial action chosen. Applies to disturbances of one acre or more of total land area and disturbances of less than one acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one or more acres of land.

TABLE 2-1
List of Potentially Applicable/Relevant and Appropriate Requirements
USS Lead Site, OU-1
East Chicago, Indiana

Potential Applicable/ Relevant and Appropriate Requirements	Description	Type of ARAR	Potentially Applicable/ Relevant and Appropriate?	Comment
	planning, regulation, education, coordination, construction, operation, maintenance, inspection, and enforcement activities. Based on CWA NPDES regulations.			

<u>Notes</u>

ARAR	Applicable/Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CSF	Cancer Slope Factor
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
IAC	Indiana Administrative Code
IC	Indiana Code
IDEM	Indiana Department of Environmental Management
IRIS	Integrated Risk Information System
LDR	Land disposal restrictions
NPDES	National Pollutant Discharge Elimination System
RCRA	Resource Conservation and Recovery Act
RISC	Risk Integrated System of Closure
RfD	Risk Reference Dose
RSL	Regional Screening Level
SDWA	Safe Drinking Water Act

TABLE 2-2
Remedial Action Levels for Soil at OU-1
USS Lead Site, OU-1
East Chicago, Indiana

Analyte Group	Analyte Name	Units	OU-1 Soil RAL	Reference
Metals	Arsenic	mg/kg	14.1	SSL
	Lead	mg/kg	400 (Residential) 800 (Industrial)	SSL
Polycyclic Aromatic Hydrocarbons	Benzo(a)anthracene	µg/kg	1,800	TACO
	Benzo(a)pyrene	µg/kg	2,100	TACO
	Benzo(b)fluoranthene	µg/kg	2,100	TACO
	Benzo(k)fluoranthene	µg/kg	1,700	TACO
	Dibenz(a,h)anthracene	µg/kg	420	TACO
	Indeno(1,2,3-CD)pyrene	µg/kg	1,600	TACO

Notes:

µg/kg	Microgram per kilogram
mg/kg	Milligram per kilogram
RAL	Remedial action level
SSL	Site screening level
TACO	Tiered Approach to Corrective Action Objectives

TABLE 3-1
SOIL GENERAL RESPONSE ACTIONS
USS Lead Site OU-1
East Chicago, Indiana

General Response Actions	Description/Comments
No Action	Under the CERCLA-mandated no-action alternative, no action will be taken at the Site with respect to remediation.
Institutional Controls	This GRA includes administrative mechanisms such as deed restrictions and use designations as well as physical actions such as posting and fencing to restrict Site access and use.
Removal	This GRA involves the excavation of impacted soils.
Disposal	This GRA includes the disposal of excavated soils at an off-site facility.
Containment	This GRA generally entails capping to isolate impacted soil from human and ecological receptors.
In Situ Treatment	This GRA includes remedies that involve implemented processes to contain, destroy, or otherwise reduce the bioavailability or toxicity of contaminants in soil. This GRA may involve physical, chemical, or biological processes. Treatment to be conducted onsite, *in situ*.
Ex Situ Treatment	This GRA includes remedies that involve implemented processes to contain, destroy, or otherwise reduce the bioavailability or toxicity of contaminants in soil. This GRA may involve physical, chemical, or biological processes. Treatment may be conducted at on- or off-site facilities.

Notes:

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
GRA General response action

TABLE 4-1
SOIL CANDIDATE TECHNOLOGIES FOR RISK MITIGATION
USS Lead Site, OU-1
East Chicago, Indiana

Candidate Technology	Description	Comments/Notes
No Action		
No action	CERCLA-mandated alternative of no action taken to mitigate risk	• CERCLA-mandated
Institutional Controls		
Property use restrictions	Stipulated limits on property use; can include posting no access and limiting use to non-intrusive activities (such as no gardens) or specific types of use (such as non-residential use); may include deed restrictions	• May also be used in conjunction with ongoing, long-term remedies that will leave behind residual contamination for an extended period of time
Property access restrictions	Restrictions to prevent property access; can be through posting or fencing	• May also be used in conjunction with ongoing, long-term remedies that will leave behind residual contamination for an extended period of time
Removal		
Mechanical excavation	Excavation of impacted soils using earth-digging or -moving construction equipment	• May be used in conjunction with capping, disposal, and *ex-situ* treatment
Disposal		
Off-site disposal to RCRA Subtitle C Hazardous Waste Landfill	Solid hazardous wastes are permanently disposed of in an off-site RCRA-permitted landfill.	• May be used in conjunction with excavation • Applicable to hazardous and non-hazardous wastes • Soil requires pre-treatment in accordance with land disposal restrictions • Required when TCLP levels exceed the allowable concentrations to non-hazardous landfills
Off-site disposal to RCRA Subtitle D Solid Waste Landfill	Solid nonhazardous wastes are permanently disposed of in an off-site solid waste landfill.	• May be used in conjunction with excavation and *ex-situ* treatment • Soil may require pre-treatment in accordance with land disposal restrictions • Applicable to non-hazardous wastes only
Containment		
Low permeability cap	Installation of a low-permeability cap such as a synthetic liner, paving, or a designed clay layer	• Provides isolation, and retards groundwater infiltration • Can limit future site re-development • May be used in conjunction with excavation of hot-spot soils • Inhibits revegetation • Anticipate minimal acceptance by community

TABLE 4-1
SOIL CANDIDATE TECHNOLOGIES FOR RISK MITIGATION
USS Lead Site, OU-1
East Chicago, Indiana

Candidate Technology	Description	Comments/Notes
Soil cover	Installation of an engineered soil cover	• Provides isolation • Can limit future site re-development • May require institutional controls • Conducive to revegetation • Minimum of 12" of cover required by *Superfund Lead-Contaminated Residential Sites Handbook* (EPA 2003)
***In Situ* Treatment**		
Chemical stabilization	Stabilization is accomplished by reducing the contaminant toxicity through decreasing contaminant mobility, solubility, and/or bioavailability. Stabilization occurs through the application of soil amendments such as phosphates (i.e., ground fish bones), iron oxyhydroxides, or limestone. Reduction of toxicity is achieved and maintained by reducing the bioavailability of the contaminant. In-situ application can be accomplished with standard soil mixing practices. In-situ stabilization avoids additional handling during treatment and typically allows resultant materials to be left in place.	• Generally considered for metals and other inorganic materials and compounds • Requires distribution of reagents throughout treatment zone • Generally requires bench-scale and pilot testing • Can limit future site re-development • Long term effectiveness of some amendments (e.g., ground fish bones) has not been proven • Increased volume of material can result from treatment
Vitrification	Subsurface heating to a temperature capable of solidifying soil matrix, thereby reducing contaminant mobility	• Generally considered for metals and inorganic compounds, also applicable for organic compounds • Requires application of heat throughout treatment zone • Generally requires bench-scale and pilot testing • Not suitable within residential properties
Bioleaching	Extraction of metals from soil particles using bacteria conveyed in water; generally involves bacteria sulfides in sulfide-bound metals, thereby releasing metals to be absorbed into conveyance water and removed from the Site; an emerging technology from the metal-ore processing field	• Considered for metals; however, different solutions may be required for lead and arsenic treatment • Not effective on organic compounds • Requires circulation of bioleaching mixture throughout treatment zone • Emerging technology for remediation • Requires bench-scale and pilot testing • Not suitable within residential properties
Biosolids remediation	Application of Class 1 biosolids to surface of impacted area; biosolids are then mixed or tilled into soil to approximate depth of 3 feet; biosolids effectively bind metals, reducing contaminant toxicity and bioavailability; emerging technology being used for reclamation of mine areas	• Generally considered effective for metals, not considered effective for organic compounds • Requires application throughout impacted area • Likely requires compliance with biosolids land application regulations that could be problematic for areas close to the Grand Calumet River • Emerging technology for remediation • Requires bench-scale and pilot testing • Not suitable within residential properties

TABLE 4-1
SOIL CANDIDATE TECHNOLOGIES FOR RISK MITIGATION
USS Lead Site, OU-1
East Chicago, Indiana

Candidate Technology	Description	Comments/Notes
Phytoremediation	Phytoremediation is a set of processes that uses plants to remove inorganics from the shallow soil and transfer them to the biomass. It is preferred that metal-accumulating plants accumulate the metals in the shoots (aboveground biomass) rather than the roots for ease in harvesting and repeated removal of accumulated metals.	• Requires harvesting of plants and disposal • Applicable to metals remediation, particularly lead, limited success for arsenic and PAHs • Climatic or seasonal conditions may interfere or inhibit plant growth, slow remediation efforts, or increase length of treatment period. • Effectiveness depends on affinity of plants to uptake targeted contaminants • Not suitable within residential properties • Not recommended by the *Superfund Lead-Contaminated Residential Sites Handbook* (EPA 2003)
***Ex Situ* Treatment**		
Soil washing	Soil washing is a water-based process for scrubbing soil *ex situ* to remove contaminants. The process removes contaminants from soil in one of two ways: (1) by dissolving or suspending contaminants in a wash solution (can be sustained by chemical manipulation of pH) or (2) by concentrating contaminants into a smaller volume of soil through particle size separation, gravity separation, and attrition.	• Generally considered for metals and inorganic compounds • Different solutions required for lead, arsenic, and PAH removal • Requires capturing, treating, and disposing of wash water • Generally requires bench-scale and pilot testing • Soil would be treated off site, and either returned to the area excavated or disposed of offsite
Pyrometallurgical recovery	Uses elevated temperature extraction and processing to remove metals from contaminated soils	• Soil containing lead and arsenic may require pretreatment • Generally produces metal-bearing waste slag that requires disposal • Generally requires bench-scale and pilot testing • Soil would be treated offsite, and either returned to the area excavated or disposed of offsite
Ex situ solidification/stabilization	Contaminants either physically bound within a stabilized mass (solidification), or chemical stabilized to reduce mobility (stabilization)	• Creates a crystalline, glassy, or polymeric framework around the waste • Effective at reducing contaminant mobility and passing TCLP testing • Not suitable for reuse as fill material at residential properties • May be used in conjunction with capping, excavation, and disposal
Chemical Extraction	Hydrochloric acid is used to extract heavy metals from soil in an acid extraction process. The soil and acid are mixed in a closed extraction unit, dissolving the inorganic contaminants into the acid. When extraction is complete (10 to 40 minutes), the soil is rinsed with water to remove the entrained acid and metals. The clean soil is then dewatered and mixed with lime and fertilizer to neutralize any residual acid.	• Generally considered for metals and inorganic compounds, less effective for organic compounds • Generally requires bench-scale and pilot testing • Soil would be treated offsite, and either returned to the area excavated or disposed of offsite

Notes:

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
PAH Polycyclic aromatic hydrocarbons
RCRA Resource Conservation and Recovery Act
TCLP Toxicity Characteristic Leaching Procedure

TABLE 4-2
SOIL REMEDIATION CANDIDATE TECHNOLOGIES SCREENING
USS Lead Site, OU-1
East Chicago, Indiana

Technology	Effectiveness	Implementability	Relative Cost	Retained?	Reason for Elimination
No Action					
No action	• Capable of handling volume of soil. • Not effective at reducing contamination. • Not effective with respect to risk reduction.	Easily implementable	Low	Yes	NA
Institutional Controls					
Property use restrictions	• Capable of handling volume of soil. • Not effective at reducing contamination. • Effective at reducing human risk.	Easily implementable	Low	Yes	NA
Property access restrictions	• Capable of handling volume of soil. • Not effective at reducing contamination. • Effective at reducing human risk.	Easily implementable	Low	Yes	NA
Removal					
Mechanical excavation	• Capable of handling volume of soil. • Not effective at reducing overall volume of contamination; excavation and off-site disposal transfers contamination to a more secure location. • Effective with respect to risk reduction.	Easily implementable	Moderate	Yes	NA
Disposal					
Off-site disposal to RCRA Subtitle C Hazardous Waste Landfill	• Capable of handling volume of soil • Not effective at reducing contamination; excavation and off-site disposal transfers contamination to a more secure location. • Effective with respect to risk reduction	Implementable	Moderate	Yes	NA
Off-site disposal to RCRA Subtitle D Solid Waste Landfill	• Capable of handling volume of soil • Not effective at reducing contamination; excavation and off-site disposal transfers contamination to a more secure location. • Effective with respect to risk reduction	Implementable	Moderate	Yes	NA

TABLE 4-2
SOIL REMEDIATION CANDIDATE TECHNOLOGIES SCREENING
USS Lead Site, OU-1
East Chicago, Indiana

Technology	Effectiveness	Implementability	Relative Cost	Retained?	Reason for Elimination
Containment					
Low-permeability cover	• Capable of handling volume of soil. • Not effective at reducing contamination. • Effective with respect to risk reduction.	Difficult to Implement	High	No	Technology has a high cost and is not suitable for use in residential areas.
Soil cover	• Capable of handling volume of soil. • Not effective at reducing contamination. • Effective with respect to risk reduction.	Easily implementable	Low	Yes	NA
***In-situ* Treatment**					
Chemical stabilization	• Capable of handling volume of soil. • Effective at reducing contamination • Effective with respect to risk reduction.	Difficult to Implement	Moderate	Yes	NA
Vitrification	• Capable of handling volume of soil. • Can be effective at reducing contamination, but only if soil is adequately exposed to treatment process. • Effective with respect to risk reduction.	Difficult to Implement	High	No	Technology has a very high cost and the byproduct will prevent future site redevelopment.
Bioleaching	• Capable of handling volume of soil. • Effective at reducing contamination • Not definitively effective with respect to risk reduction. • Must be combined with groundwater collection method to capture leaching metals.	Difficult to Implement	Moderate	No	Range of microorganisms required to address multiple contaminants in subsurface. Extensive pilot testing would be required to design. Uncertainty with regard to risk reduction.
Biosolids remediation	• Capable of handling volume of soil. • Effective at reducing contamination • Not effective with respect to risk reduction.	Difficult to Implement	Moderate	No	Technology is not suitable for use in residential areas.

TABLE 4-2
SOIL REMEDIATION CANDIDATE TECHNOLOGIES SCREENING
USS Lead Site, OU-1
East Chicago, Indiana

Technology	Effectiveness	Implementability	Relative Cost	Retained?	Reason for Elimination
***In-situ* Treatment**					
Phytoremediation	• Capable of handling volume of soil. • Generally effective at reducing surface level metals contamination only, not effective at reducing subsurface or organic contamination. • Not definitively effective with respect to risk reduction.	Implementable	Low	No	According to the *Superfund Lead-Contaminated Residential Sites Handbook*, phytoremediation is not currently an appropriate technology for residential lead cleanups due to several factors: (1) the lead concentrations at many residential sites are not within the optimal performance range for the plants; (2) the plants may concentrate lower-level lead contamination and present an increased disposal cost if the plants fail the TCLP test, but the un-remediated yard soil does not fail; (3) the length of time required for remediation; (4) the potential conflicts with local regulations pertaining to yard maintenance; and (5) the depth of remediation achieved may be inadequate (EPA 2003).
***Ex-situ* Treatment**					
Soil washing	• Capable of handling volume of soil. • Effective at reducing contamination. • Effective with respect to risk reduction.	Implementable	Moderate	No	Range of washing solutions required to address multiple contaminants. Extensive pilot testing would be required to design. Uncertainty with regard to risk reduction. Would still require on-site consolidation or off-site disposal.
Pyrometallurgical recovery	• Capable of handling volume of soil. • Effective at reducing contamination. • Effective with respect to risk reduction.	Difficult to Implement	High	No	Metals in soil concentrations are likely too low to make metals recovery worthwhile. Technology has high cost and is very difficult to implement; other *ex situ* treatments more effective, easier to implement, and less expensive
Ex situ solidification/ stabilization	• Capable of handling volume of soil. • Effective at reducing contamination. • Effective with respect to risk reduction.	Implementable	Moderate	Yes	NA
Chemical extraction	• Capable of handling volume of soil. • Effective at reducing contamination. • Effective with respect to risk reduction.	Implementable	High	No	Range of extraction solutions required to address multiple contaminants, less effective for organic contamination. Extensive pilot testing would be required to design. Would still require on-site consolidation or off-site disposal.

Notes:

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
NA Not Applicable
RCRA Resource Conservation and Recovery Act

TABLE 4-3
SOIL RETAINED TECHNOLOGIES FOR RISK MITIGATION
USS Lead Site, OU-1
East Chicago, Indiana

General Response Action	Candidate Technology	Comments
No Action	No Action	• CERCLA-mandated
Institutional Controls	Property use restrictions	• May be used in conjunction with ongoing, long-term remedies that will leave behind residual contamination for an extended period of time
	Property access restrictions	• May be used in conjunction with ongoing, long-term remedies that will leave behind residual contamination for an extended period of time
Excavation	Mechanical excavation	• Likely will be used in conjunction with disposal at Subtitle C or Subtitle D Landfill • May be used in conjunction with *ex situ* treatment, as required
Disposal	Off-site disposal to RCRA Subtitle C Hazardous Waste Landfill	• May be used in conjunction with excavation • May be used in conjunction with *ex situ* treatment to address soil exceeding TCLP disposal criteria, as required
	Off-site disposal to RCRA Subtitle D Solid Waste Landfill	• May be used in conjunction with excavation • May be used in conjunction with *ex situ* treatment to address soil exceeding TCLP disposal criteria, as required
Containment	Soil cover	• Provides isolation • Can limit future Site re-development • Conducive to revegetation • Minimum of 12" of cover required by *Superfund Lead-Contaminated Residential Sites Handbook* (EPA 2003)

TABLE 4-3
SOIL RETAINED TECHNOLOGIES FOR RISK MITIGATION
USS Lead Site, OU-1
East Chicago, Indiana

General Response Action	Candidate Technology	Comments
***In Situ* Treatment**	Chemical Stabilization	• May be used in conjunction with Institutional Controls • Can limit future Site re-development
***Ex Situ* Treatment**	*Ex Situ* Stabilization	• To be used in conjunction with excavation and disposal at Subtitle C or Subtitle D Landfill

<u>Notes</u>

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
RCRA Resource Conservation and Recovery Act
TCLP Toxicity Characteristic Leaching Procedure